EXECUTIVE SUMMARY

This first volume of the Accreditation Support Package (ASP-I) is designed to provide a potential user with a characterization of the current status of the subject model with respect to criteria related to its general acceptability for use. The information presented in this volume should characterize the model well enough to provide an initial determination of its suitability for a particular application. It should also provide confidence that the model is well enough managed and supported to yield consistent results across its spectrum of users and applications. The information provided to characterize the subject model consists of the following elements.

a. A description of the configuration management baseline for the model, including version history, current version status, model development policy (including beta site provisions), documentation availability, and a summary of configuration management policies, procedures, guidelines and support functions in place for the model;

b. A summary of implicit and explicit assumptions and limitations inherent in the model because of its design and/or coding assumptions or structure, as well as any implied constraints to the use of the model that are a consequence of these assumptions or structures. A listing of known errors or anomalies found as a result of prior V&V efforts is also included;

c. A review of the model's development, verification and validation (V&V) and usage histories, as well as a summary of prior accreditations;

d. A review of the status of model documentation and its conformity to accepted software documentation standards, as well a review of documentation with respect to verification requirements, and;

e. A summary of overall software quality as characterized by conformance to accepted design and coding practices.

ASP-I provides the details of these information elements in a single document. The degree to which each information element is complete and current provides a general indication of whether the model is suitable for further consideration for use in a particular application.

Configuration Management Baseline: The BRAWLER model (formerly known as TAC BRAWLER) is maintained for the U.S. Air Force Studies and Analysis Agency (AFSAA) by Major Al Gracia (AFSAA/SAG). The software and documentation are maintained under contract by Decision-Science Applications, Inc. (DSA) located in Arlington, VA and distributed throughout the DoD by the SURVIAC located at Wright-Patterson AFB, OH. The current version (6.2) of the model was released in November of 1995, but most of the material reported here is based upon the previous version (6.15), which was available at the time tasking was initiated in June of 1995. Where facts stated are applicable to specific versions, they are annotated by the appropriate version number. Unclassified databases and sample cases are also distributed by SURVIAC and users needing classified data specific to threat aircraft and systems may obtain them through Major Gracia at AFSAA. The software is mostly written in FORTRAN 77, but a few C routines are also included. The SUN or Silicon Graphics workstations are the typical target platforms, although earlier versions also ran on Digital Equipment VAX computers.

The CM process is informal (i.e., no CCB exists), and all decisions regarding enhancements and changes are made through coordination between Major Gracia and DSA. Procedures for management of code changes are controlled by proprietary software designed and developed by DSA. Four beta sites have been identified. User Group meetings are held annually and two training courses are provided by DSA at regular intervals throughout the year. A bulletin board service (BBS) is also available for users to call and report software problems and request assistance. Two types of support agreements are also available from DSA.

Assumptions, Limitations, and Errors: A tabular listing of assumptions and limitations are provided in Section 3 along with brief descriptions of 19 errors known to exist. Potential impact of these was assessed as minor except for scenarios including surface-to-air missiles (SAMs) and countermeasure effects. Assumptions regarding weather and terrain effects are also areas that could concern some users of the model.

V&V Status and Usage History: A survey of the BRAWLER user community was conducted by sending questionnaires to 114 users and compiling responses received from 59 individuals in 27 organizations. Of those, 35 reported performance of V&V activities, 6 reported accreditation, 9 compared results with other models, and 6 reported comparisons with test data. Of the 102 air-to-air analysts on record with SURVIAC, 63 use BRAWLER and the remaining 39 use some version of AASPEM. Descriptions of 20 uses provided by survey respondents regarding analysis and V&V related activities are described in this section along with several major studies that were supported by use of the model. V&V report documents are also described where applicable.

Usage of BRAWLER has been extensive among airframe builders like Lockheed Martin, Northrop Grumman, McDonnell Douglas, as well as among government agencies like ASC, CNA, NAIC, RAND, and Wright Laboratory. BRAWLER is a mature model with a large user base, but this is its primary statement of credibility. Reports of accreditation efforts are not available.

Documentation Assessment: Brawler documentation for version 6.15 has three of the recommended documents: a Software User's Manual (SUM), a Software Programmer's Manual (SPM), and a Software Analyst's Manual (SAM). However, no Software Design Document (SDD) currently exists. The documentation was found to be compliant with the exception of some minor recommended modifications. Recommendations for completing each of the manuals is provided in Section 5. The SUM came closest to meeting required criteria. High level and detailed module hierarchy, variable dictionary, diagnostic features, and module descriptions are missing from the SPM. The SAM contains good high level information, but limited detailed discussions of implemented methodology.

Software Quality Assessment: Software for version 6.2 was examined and quality assessed relative to criteria associated with four measures; 1) Use of Standards, 2) Programming Conventions, 3) Computational Efficiency, and 4) Maintainability. Of the 3,679 subroutines, functions, include files, and other modules available, 123 were selected for analysis, but 12 of these proved to be dummy or stub routines. Scores were compiled for each criteria and averaged for the 111 source code modules to arrive at a 92.7% compliance rating relative to the chosen criteria.

Developers of BRAWLER have adopted many good programming practices and deserve credit for their efforts in getting programmers to adhere to them over the years. However, a few areas for potential improvement were noted. For example, all module headers contained a section for Variable Descriptions, but in most cases they were blank. Many GOTO statements were found and even though some were well documented, others made the code difficult to follow. Few routines identified callers or modules called by them.

The incremental development process applied to BRAWLER was evident in terms of unused statements and existence of dummy subprogram units. Given its large size and age, however, BRAWLER code is well structured and remarkably up to date with current programming practices.